

WATERLOO

***water pollution
control plant***

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ONTARIO WATER RESOURCES COMMISSION
OFFICE OF THE GENERAL MANAGER

Members of the Waterloo Local Advisory Committee,
City of Waterloo.

Gentlemen:

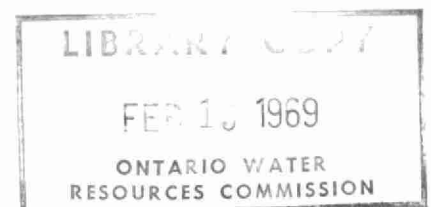
We are happy to present you with the 1967 Operating Summary for the
Waterloo Water Pollution Control Plant, OWRC Project No. 2-0022-58.

Your co-operation with our staff throughout the year has been appreciated.
Only with such co-operation can the war against water pollution be waged
effectively.

Yours very truly,

A handwritten signature in dark ink, appearing to read "D. S. Caverly".

D. S. Caverly,
General Manager.





ONTARIO WATER RESOURCES COMMISSION

801 BAY STREET

TORONTO 5

TELEPHONE 365-

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J. H. H. ROOT, M.P.P.
VICE-CHAIRMAN

D. S. CAVERLY
GENERAL MANAGER

W. S. MACDONNELL
COMMISSION SECRETARY

General Manager,
Ontario Water Resources Commission.

Dear Sir:

I am pleased to submit to you the 1967 Operating Summary for the Waterloo Water Pollution Control Plant, OWRC Project No. 2-0022-58.

The summary reviews progress during the year, outlines operating problems encountered and summarizes in graphs, charts and tables all significant flow and cost data.

Yours very truly,

A handwritten signature in dark ink, reading "D. A. McTavish". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

D. A. McTavish, P. Eng.,
Director,
Division of Plant Operations.

FOREWORD

● This operating summary has been prepared in order to acquaint readers with the management of the project during 1967. The efficiency of the plant's operation is reflected in a general review. Significant financial details are recorded, and technical performance is illustrated by graphs and charts.

The summary should answer two salient questions. Are the project's facilities adequate at this time? And can the project meet future requirements?

The Regional Operations Engineer is primarily responsible for the preparation of the report, and will be pleased to answer any questions regarding it.

Most of the material for the graphs and charts was compiled by the statistics section of the Division of Plant Operations, with the final versions of the graphs being drawn by the draughting section of the Division of Sanitary Engineering. Cost data were provided by the Division of Finance.

It will be evident from the report that all of these groups co-operated with substantial success.

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WATERLOO
water pollution control plant
operated for

THE CITY OF WATERLOO

by the

ONTARIO WATER RESOURCES COMMISSION

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Assistant Director: C. W. Perry
Regional Supervisor: A. C. Beattie
Operations Engineer: B. W. Hansler

801 Bay Street Toronto 5

'67 REVIEW

A total of 1456,862 million gallons of sewage was treated during the year at a total cost of \$142,609.57. The operating cost per pound of BOD removed has remained constant at \$0.04 since 1965.

The average daily flow during 1967 of 3.99 million gallons represented an increase of 27.9 percent over the previous year's 3.12 million gallons.

During the year the plant reduced the BOD and suspended solids concentrations with average reductions of 93.4 percent and 92.7 percent respectively. The average effluent BOD and suspended solids concentrations were 19 ppm and 20 ppm respectively.

Construction of the plant expansion began during the year.

Under the supervision of head office engineers the plant staff operated a clean, attractive and efficient plant for the City of Waterloo.

PROJECT COSTS

STAGE 1

NET CAPITAL COST (Final) Long Term Debt to OWRC	<u>\$728,675.93</u>
Debt Retirement Balance at Credit (Sinking Fund) December 31, 1967	<u>\$221,238.98</u>
Net Operating	\$142,609.57
Debt Retirement	26,436.00
Reserve	4,752.07
Interest Charged	41,092.55
	<hr/>
TOTAL	<u>\$214,890.19</u>

RESERVE ACCOUNT

Balance at January 1, 1967	\$ 22,917.00
Deposited by Municipality	4,752.07
Interest Earned	<u>1,398.46</u>
	\$ 29,067.53
Less Expenditures	<u>(2,106.93)</u>
Balance at December 31, 1967	<u>\$ 26,960.60</u>

STAGE 2

NET CAPITAL COST (Final) Long Term Debt to OWRC	\$13,226.41
--	-------------

Debt Retirement Balance at Credit (Sinking Fund) December 31, 1967	\$ 3,138.78
---	-------------

Net Operating	\$ -
Debt Retirement	552.00
Reserve	138.30
Interest Charged	745.88
	<hr/>
TOTAL	\$ 1,436.18

RESERVE ACCOUNT

Balance at January 1, 1967	\$ 723.72
Deposited by Municipality	138.30
Interest Earned	<u>44.08</u>
	\$ 906.10
Less Expenditures	<hr/>
Balance at December 31, 1967	\$ <u>906.10</u>

SPECIAL OPERATING AGREEMENT

BILLINGS

Reserve \$1,400.00

RESERVE ACCOUNT

Balance at January 1, 1967	\$ 704.40
Deposited by Municipality	1,400.00
Interest Earned	<u>71.05</u>
	\$2,175.45
Less Expenditures	<u>-</u>
Balance at December 31, 1967	<u>\$2,175.45</u>

MONTHLY OPERATING COSTS

MONTH	TOTAL EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIRS & MAINTENANCE	* SUNDRY
JAN	5119.91	3010.06		175.20			48.40	6.37	136.72	1743.16
FEB	8676.01	3659.99			2215.34		265.96		510.67	2024.05
MARCH	10844.08	4921.30	465.45	394.20	2154.03	1176.00	207.73	14.33	532.57	978.47
APRIL	10056.76	3052.34	640.14	350.40	2819.88	495.92	482.26	66.88	527.99	1620.95
MAY	16610.21	3581.43	473.91	175.20	2325.45	7860.31	250.60	621.47	370.15	951.69
JUNE	9742.36	3592.12	346.55	168.20	2329.35	1804.44	366.02	44.67	524.22	566.79
JULY	14021.03	3579.02	401.24		2240.19	2122.78	273.16	14.07	420.06	4970.51
AUG	11819.80	3864.53	348.58		2089.59	1873.81	177.56	665.00	44.87	2755.86
SEPT	10624.00	5489.11	440.67		2233.90	361.61	128.25	39.17	265.23	1655.98
OCT	16764.79	3731.18	44.77	176.22	4195.68	5019.32	351.21	13.88	324.98	2847.55
NOV	10693.02	3300.09	212.58	204.40		247.96	166.50		163.98	6397.51
DEC	17637.60	2681.18	232.32	262.80	4669.92	2940.73	415.06	33.65	2585.83	2816.11
TOTAL	142609.57	45462.35	8606.21	1906.82	27273.41	23902.88	3132.71	1519.49	6467.27	29338.63

* SUNDRY INCLUDES SLUDGE HAULING COSTS WHICH WERE \$21,375.55

YEARLY OPERATING COSTS

YEAR	M. G. TREATED	TOTAL COST	COST PER MILLION GALLONS	COST PER LB OF BOD REMOVED
1961	599.373	\$ 80710.00	\$ 134.25	-
1962	736.953	86442.00	117.30	2 CENTS
1963	762.446	96410.00	126.45	2 CENTS
1964	852.937	112363.00	131.74	2 CENTS
1965	924.094	140427.32	151.96	4 CENTS
1966	1139.852	120343.71	105.58	4 CENTS
1967	1456.862	142609.57	97.89	4 CENTS

VACUUM FILTER COSTS (MONTHLY)

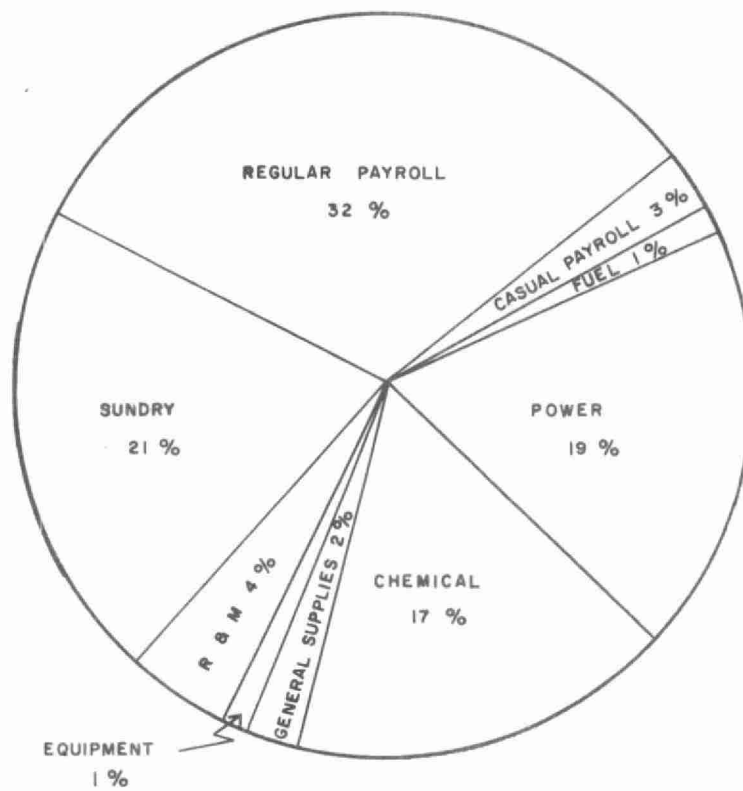
MONTH	COST PER MONTH					TOTAL	COST PER TON DRY WEIGHT					TOTAL
	FeCl ₃	LIME	LABOUR	ELEC	MAINT		FeCl ₃	LIME	LABOUR	ELEC	MAINT	
JANUARY	*	*	546.90	116.05	118.88	1710.22	*	*	4.71	1.00	1.02	14.73
FEBRUARY	*	*	678.16	133.02	147.40	2022.72	*	*	6.00	1.00	1.11	16.11
MARCH	82.53	64.75	751.08	149.54	163.26	2264.57	4.62	3.62	5.02	1.00	1.09	23.35
APRIL	697.54	465.68	700.03	174.36	152.16	2189.75	4.00	2.67	4.01	1.00	0.87	12.55
MAY	774.14	547.54	853.16	198.47	185.44	2558.75	3.90	2.76	4.30	1.00	0.93	12.89
JUNE	482.22	371.59	561.48	147.76	122.04	1685.09	3.26	2.13	3.21	1.00	0.83	10.43
JULY	526.36	466.47	765.66	158.30	166.42	2083.21	3.33	2.95	4.84	1.00	1.05	13.17
AUGUST	272.36	270.27	408.35	101.02	88.76	1140.76	2.70	2.68	4.04	1.00	0.88	11.30
SEPTEMBER	366.84	221.76	503.15	109.98	109.37	1311.10	3.34	2.02	4.57	1.00	0.97	11.92
OCTOBER	491.07	315.15	328.14	174.68	71.33	1380.37	2.81	1.80	1.88	1.00	0.41	7.90
NOVEMBER	531.65	372.26	714.62	153.72	155.33	1927.58	3.46	2.42	4.65	1.00	1.01	12.54
DECEMBER	299.60	211.50	481.27	112.64	104.61	1209.62	2.66	1.88	4.27	1.00	0.93	10.74
TOTAL	4524.31	3306.95	7292.00	1729.54	1585.00	21483.74						
AVERAGE PER MONTH	452.43	330.70	607.67	144.13	132.08	1790.31	3.41	2.49	4.29	1.00	0.93	13.14

* POLYELECTROLYTE USED IN LIEU OF CAO AND FeCl₃ AS FOLLOWS:

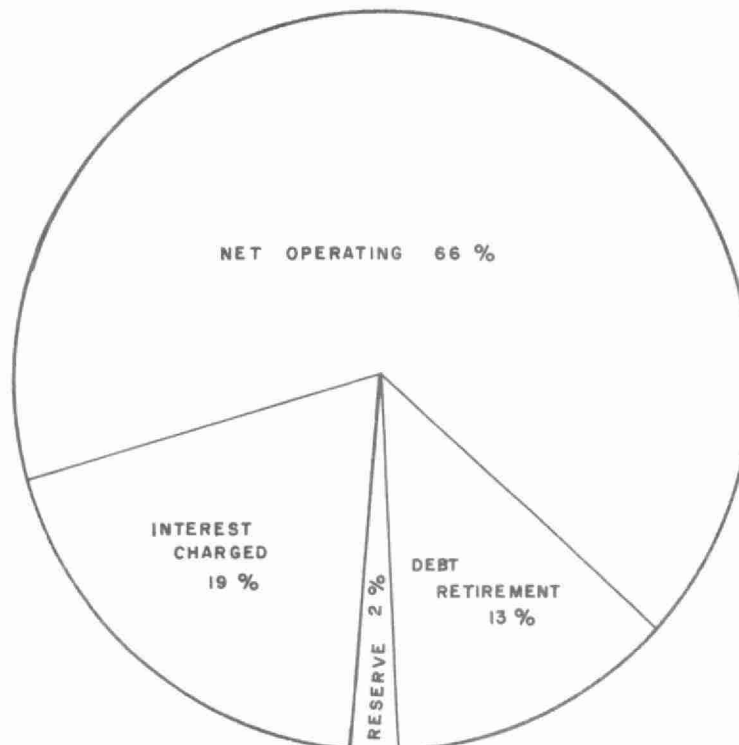
	COST PER MONTH	COST PER TON DRY WEIGHT
JANUARY	928.39	8.00
FEBRUARY	1064.14	8.00
MARCH	1053.41	8.00

THESE VALUES HAVE BEEN INCLUDED IN "TOTAL" COLUMNS ABOVE.

1967 OPERATING COSTS



TOTAL ANNUAL COST

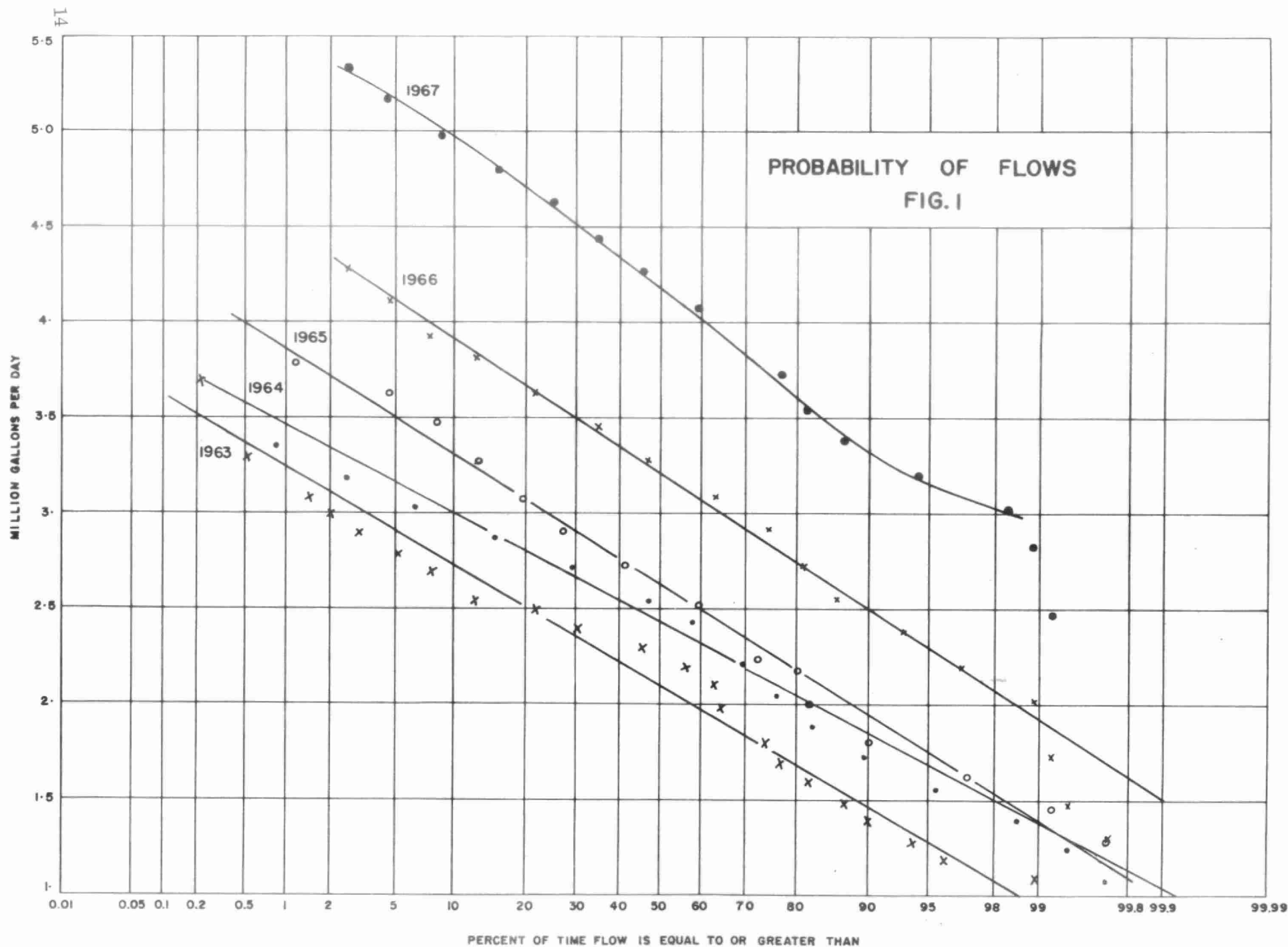


Process Data

The average daily flow of 3.99 mg represents a 27.9 percent increase over the 3.12 mg recorded in 1966. The minimum average daily flow for the year of 3.65 mg occurred in February and the maximum of 4.23 mg in December. The design daily flow of 4 million gallons per day was exceeded 50 percent of the time. The average daily flow in 1966 was exceeded 7 percent of the time.

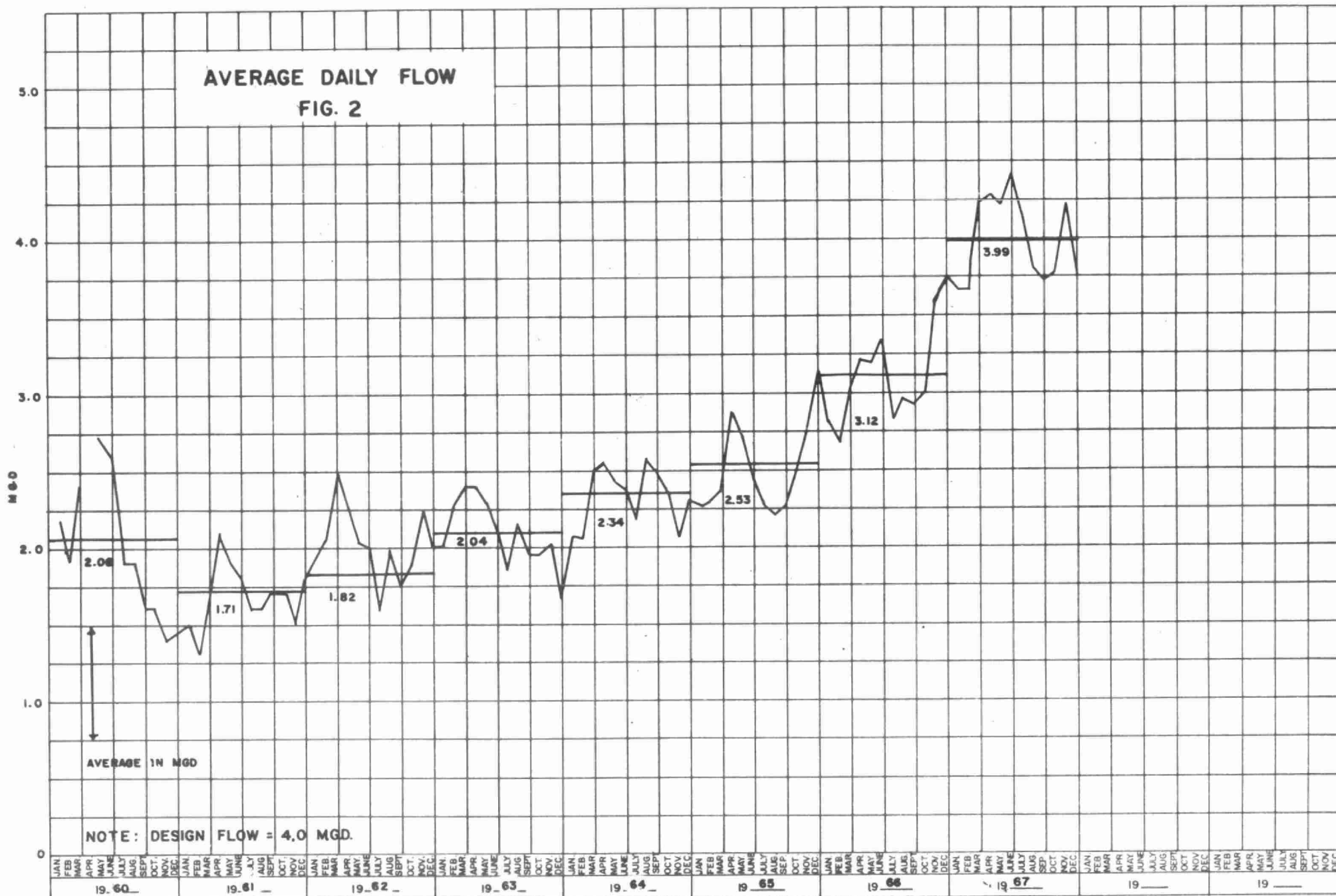
The design raw sewage BOD concentration of 300 ppm was exceeded 50 percent of the time. The raw sewage BOD averaged 290 ppm for the year. It can be shown that the average BOD loading was 11,600 pounds per day, 96.6 percent of the design loading of 12,000 pounds.

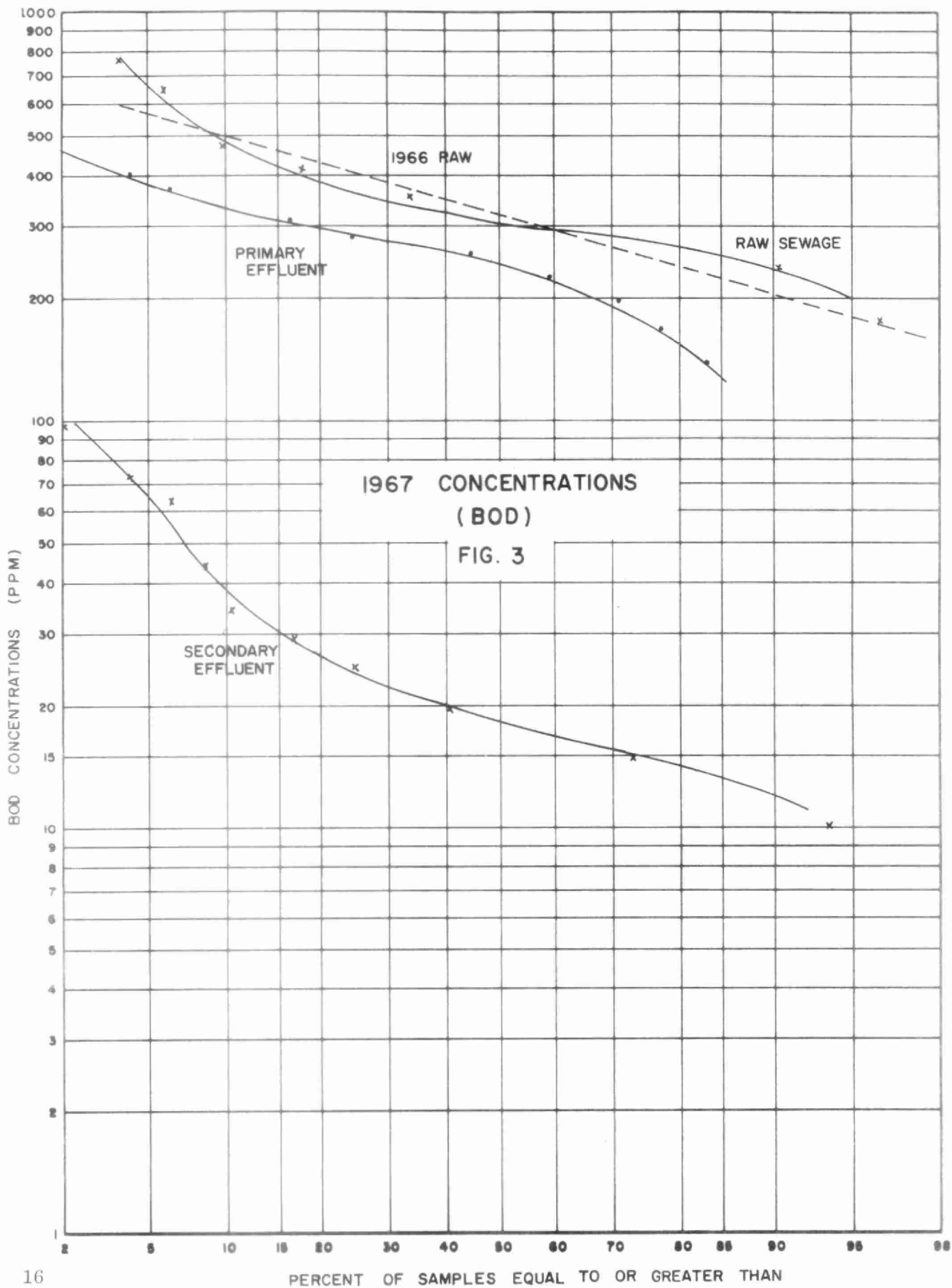
The design raw sewage suspended solids concentration of 270 ppm was exceeded 55 percent of the time. The raw sewage suspended solids averaged 284 ppm, contributing a load of 11,300 pounds per day, which is 105 percent of the design value of 10,800 pounds. The plant effluent BOD and suspended solids concentrations exceeded the OWRC objective of 15 ppm 75 percent and 82 percent of the time respectively. The average effluent BOD and suspended solids concentrations were 19 ppm and 20 ppm respectively.

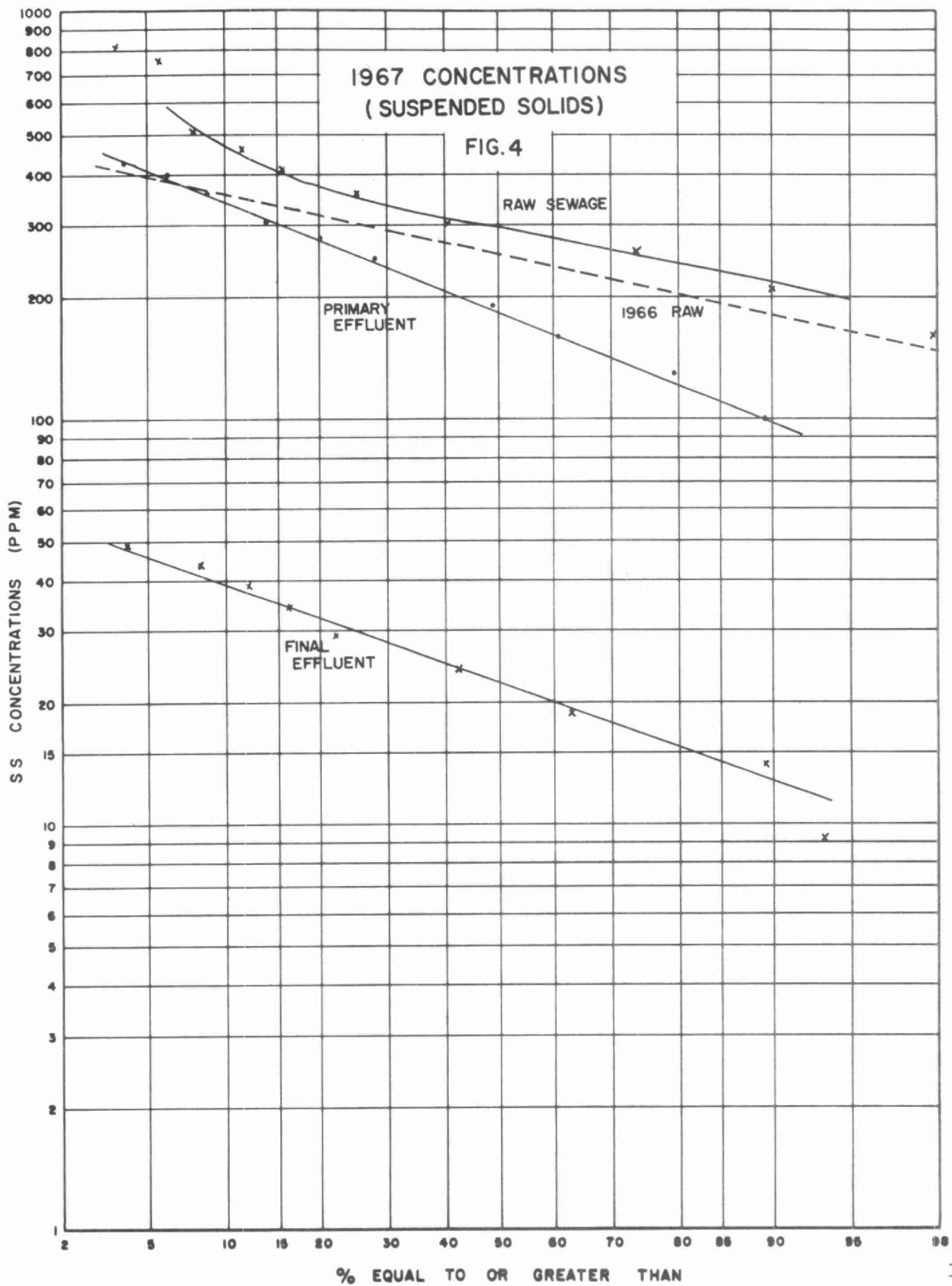


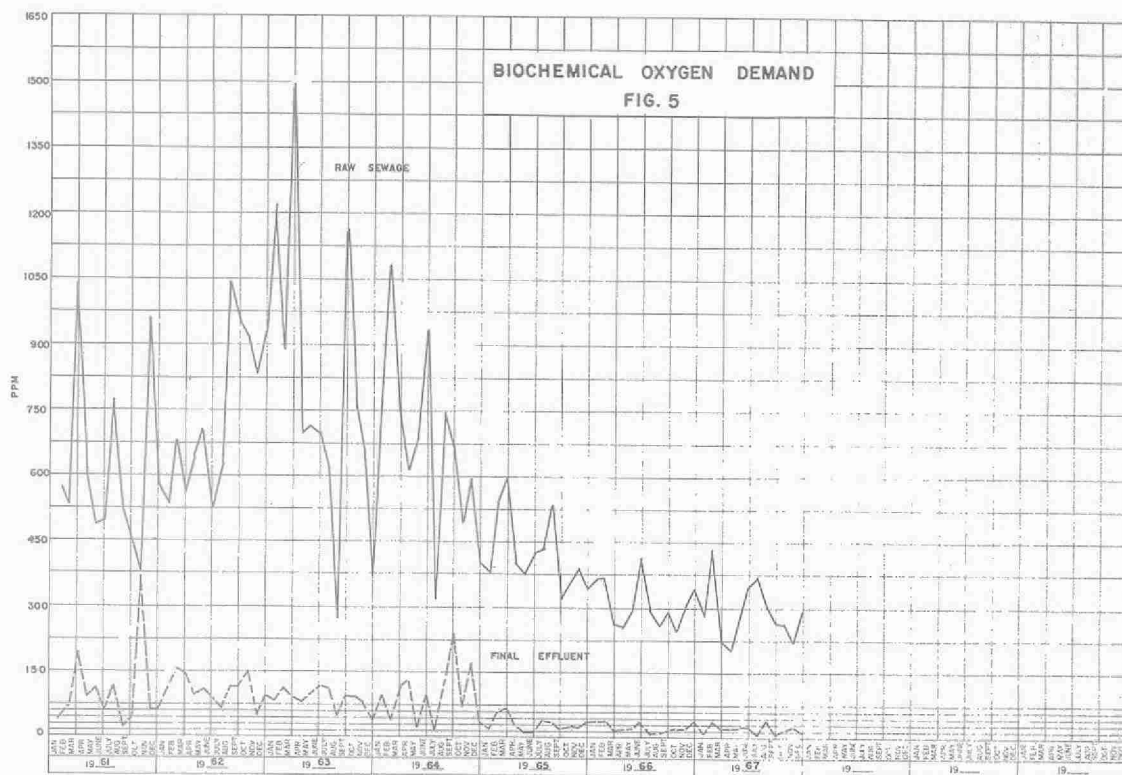
AVERAGE DAILY FLOW

FIG. 2

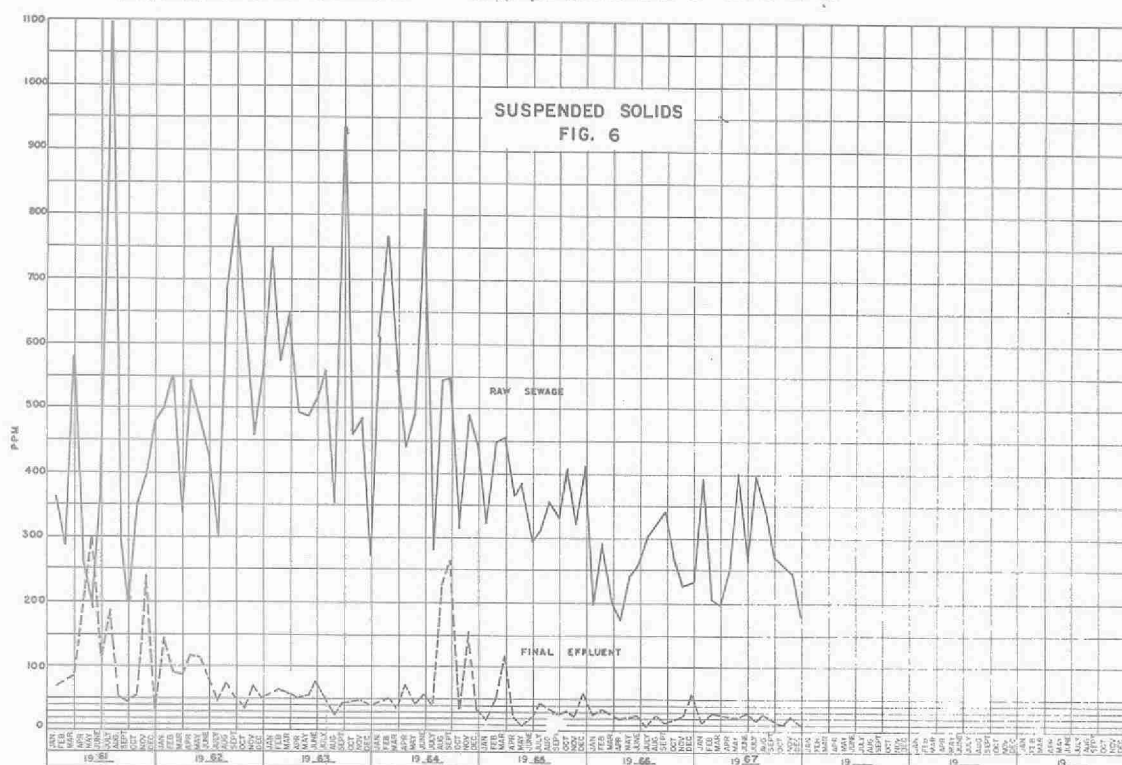








MONTHLY VARIATIONS



GRIT, B.O.D AND S.S. REMOVAL

MONTH	B. O. D.				S. S.				GRIT REMOVAL CU. FT.
	INFLUENT PPM.	EFFLUENT PPM.	% REDUCTION	TONS REMOVED	INFLUENT PPM.	EFFLUENT PPM.	% REDUCTION	TONS REMOVED	
JAN.	273	14	94.9	146.91	391	12	96.9	214.98	50
FEB.	432	33	92.4	204.05	205	27	86.8	91.03	41.5
MAR.	220	19	91.4	131.80	197	26	86.8	112.12	48
APR.	202	17	91.6	117.34	252	22	91.3	145.89	227.5
MAY	281	22	92.2	169.54	400	23	94.2	246.78	184
JUNE	345	24	93.0	213.36	265	27	89.8	158.20	52
JULY	372	8.2	97.8	234.02	399	16	96.0	246.38	34.5
AUG.	304	37	87.8	157.37	345	27	92.2	187.43	51
SEPT.	269	9.5	96.5	145.60	274	17	95.5	144.19	56
OCT.	265	15	94.3	145.98	259	10	96.1	145.40	120
NOV.	224	19	91.5	130.06	248	22	91.1	143.39	65
DEC.	288	9	96.9	163.01	177	7	96.0	99.33	37
TOTAL	-	-	-	1959.04	-	-	-	1935.12	918.5
AVG.	290	19	93.4	163.25	284	20	92.7	161.26	77

COMMENTS

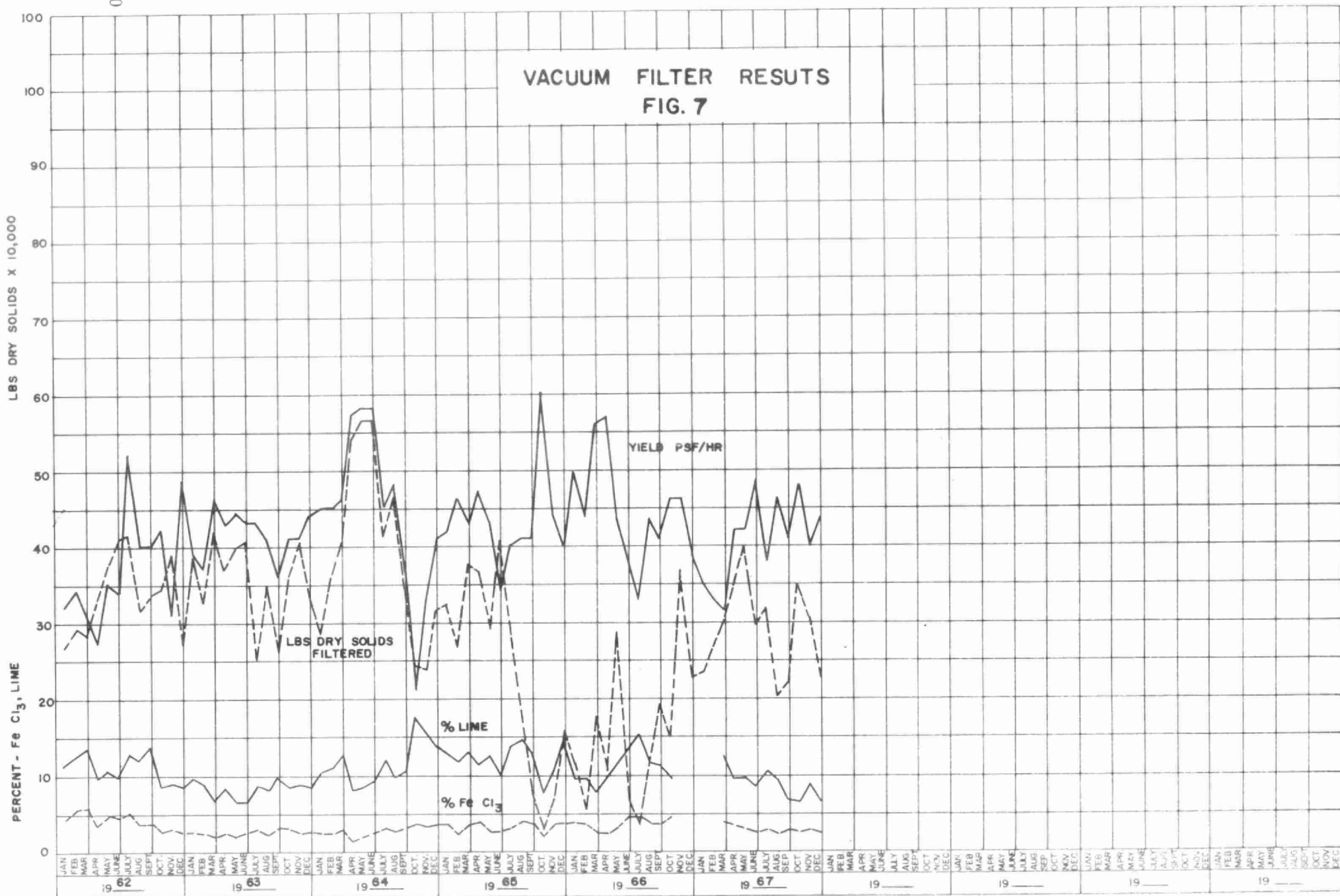
The average raw sewage BOD was 290 ppm, which is 96.5 percent of the design value of 300 ppm. The average plant effluent BOD concentration was 19 ppm. This represents an average BOD reduction of 93.4 percent.

The average raw sewage suspended solids concentration was 284 ppm which is 105 percent of the design value of 270 ppm. The plant effluent suspended solids concentration was 20 ppm. This represents an average suspended solids reduction of 92.7 percent.

A total of 918.5 cu. ft. of grit was removed during the year. This represents 0.6 cu. ft. of grit per million gallons of sewage treated.

VACUUM FILTER RESULTS FIG. 7

LBS DRY SOLIDS X 10,000

PERCENT - FeCl_3 , LIME

VACUUM FILTER OPERATION

MONTH	% SOLIDS FILTRATE	FILTER HOURS	% SOLIDS SLUDGE	LBS. DRY SOLIDS FILTERED	LBS. LIME (AS CAO)	% LIME (AS CAO)	LBS. FeCl ₃	% FeCl ₃	% SOLIDS FILTERED SLUDGE	YIELD PSF/HOUR
JAN.	0.8	197.0	4.7	232098	* 4832				15.2	3.5
FEB.	0.8	243.0	4.7	266037	* 5995				14.9	3.3
MAR.	0.9 0.5	242.5 28.0	4.6 4.9	263351 35728	* 7183 4445	12.4	1308	3.7	14.1 14.3	3.1 3.2
APR.	0.6	251.5	5.5	348714	31960	9.2	10882	3.1	16.8	4.2
MAY.	0.6	307.5	5.2	396939	37580	9.5	12077	3.0	16.2	4.2
JUNE	0.6	201.0	5.6	295527	25505	8.6	7523	2.5	17.2	4.8
JULY	1.3	274.5	4.6	316601	32015	10.1	8148	2.6	17.0	3.8
AUG.	1.0	146.0	5.3	202033	18550	9.2	4249	2.1	21.6	4.6
SEPT.	1.0	181.5	4.7	219962	15220	6.9	5723	2.6	17.7	4.1
OCT.	1.0	117.0	5.6	349359	21630	6.2	7661	2.2	21.4	4.8
NOV.	1.0	258.0	4.7	307442	25550	8.3	8294	2.7	17.9	4.0
DEC.	0.8	174.0	5.1	225274	14515	6.4	4674	2.1	17.4	4.4
TOTAL		2621.5		3459065	226970		70539			
AVG.	0.8	218.5	5.0	288255	25218	8.4	7838	2.6	17.3	4.0

* POLYELECTROLYTE USED IN LIEU OF CAO AND FeCl₃

MARCH: 21 DAYS USE POLY

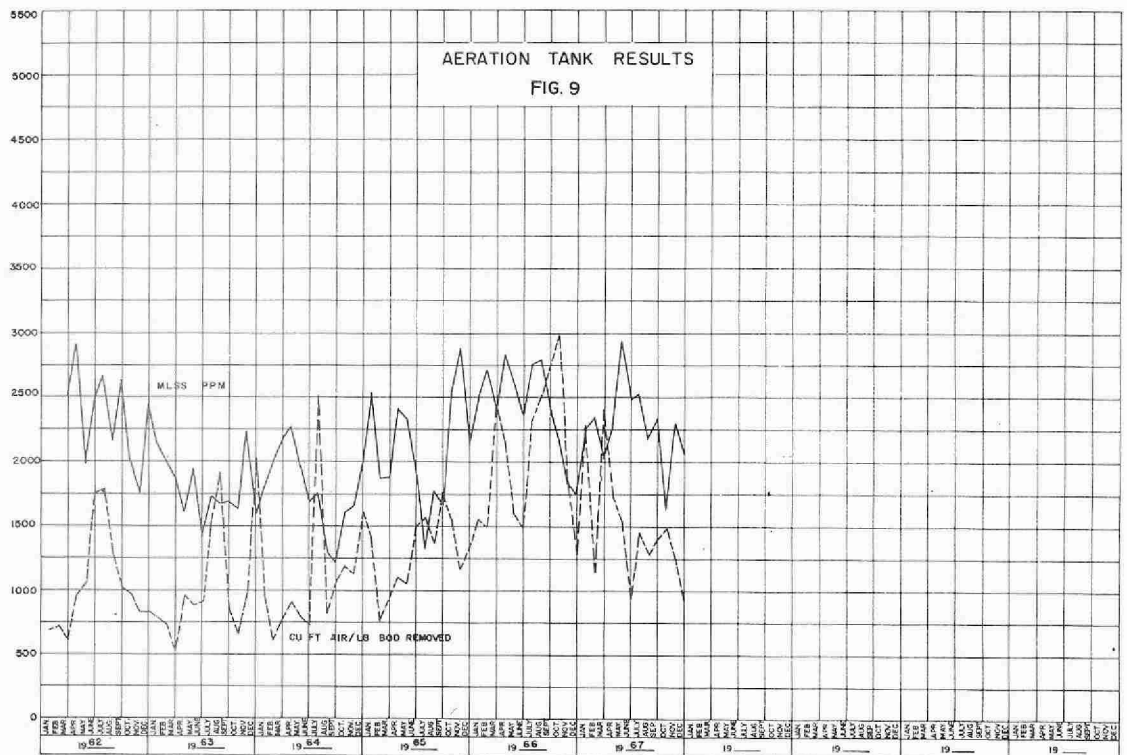
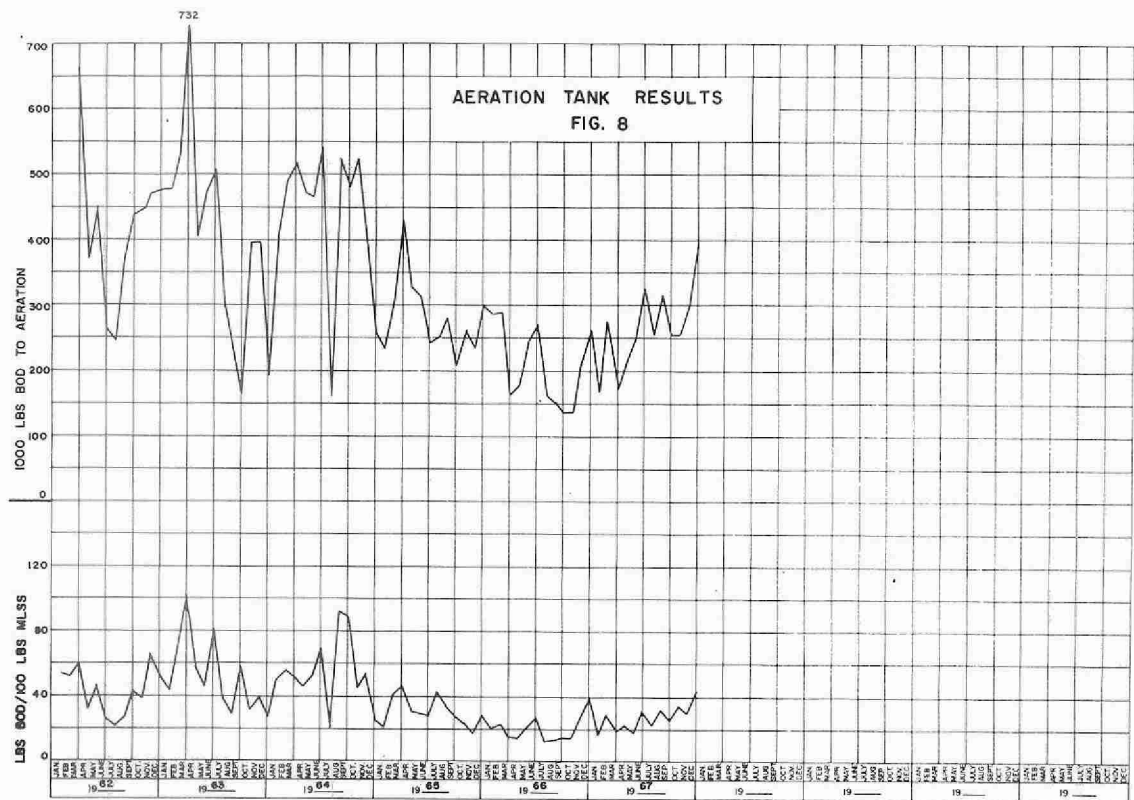
3 DAYS USE CAO AND FeCl₃

TOTAL POLY USED = 18010 LB.

AS % DSF = 2.4

COMMENTS

During 1967 the filter was operated on an average of 218.5 hrs. per month. The vacuum filter reduced the moisture content of the sludge from 95.0 percent to 82.7 percent. The average filter yield of 4.0 lbs. per sq. ft. per hour is comparable to other plants filtering raw and waste activated sludge.



AERATION SECTION

MONTH	PRIM. EFFL B.O.D. PPM.	ML.SS. PPM.	LBS. BOD. PER 100 LBS. M. L. S. S.	CUBIC FEET AIR PER LB. BOD. REMOVED
JANUARY	148	2252	16	2256
FEBRUARY	268	2349	28	1145
MARCH	130	2030	18	2392
APRIL	170	2290	21	1735
MAY	189	2945	18	1539
JUNE	245	2452	30	948
JULY	198	2470	22	1426
AUGUST	268	2161	31	1278
SEPTEMBER	225	2330	24	1393
OCTOBER	218	1648	33	1469
NOVEMBER	235	2287	29	1229
DECEMBER	340	2073	41	901
TOTAL	-	-	-	-
AVERAGE	220	2274	26	1476

COMMENTS

The average primary effluent BOD concentration of 220 ppm is approximately the same as the average primary effluent BOD concentration of 214 ppm in 1966.

The average loading on the aeration section of 26 lbs. of BOD per 100 lbs. of MLSS is within the acceptable range for the conventional activated sludge process.

SLUDGE

MONTH	SLUDGE TO FILTERS gallons	FILTER CAKE HAULED cu. yds.	LIQUID SLUDGE HAULED cu. yds.
January	490023	544	1325
February	586766	670	228.5
March	645405	627	637.5
April	631652	945	487.5
May	765198	996	1839.5
June	522002	740	1618.5
July	688373	817	2098
August	379474	468	1362
September	468521	553	2371.5
October	636105	750	342.5
November	649471	863	104
December	443088	531	350.5
Total	6906078	8,504	12735
Average	575507	709	1061

COMMENTS

A total of 8,504 cu. yds. of filtered sludge was removed in 1967.

There was more sludge produced that could be dewatered by vacuum filtration. The excess sludge was removed by tank truck. The volume of liquid raw sludge removed by tank truck was 12,755 cu. yds. during the year.

A total of 53,700 cu. yds. of liquid raw sludge was removed from the sewage during the year utilizing both the vacuum filter and liquid sludge haulage.

CHLORINATION

MONTH	PLANT FLOW (MG)	POUNDS CHLORINE	DOSAGE RATE (PPM)
JANUARY	113.447	4505	3.97
FEBRUARY	102.280	4930	4.82
MARCH	131.141	6465	4.92
APRIL	126.857	* 6495	5.49
MAY	130.918	6440	4.91
JUNE	132.937	6330	4.76
JULY	128.656	5360	4.16
AUGUST	117.882	** 6660	5.84
SEPTEMBER	112.212	5670	5.05
OCTOBER	116.783	6365	5.45
NOVEMBER	126.893	6704	5.28
DECEMBER	116.856	5285	4.52
TOTAL	1456.862	72209	-
AVERAGE	121.405	5934	4.93

* Chlorination for 28 days

** Chlorination for 30 days

COMMENTS

An average chlorine dosage rate of 4.93 ppm was required to maintain an average chlorine residual of 0.5 ppm.

LABORATORY LIBRARY



96936000119603

CONCLUSIONS

The average BOD and suspended solids reduction efficiencies were 93.4 and 92.7 percent respectively. The average daily flow during the year was 3.99 million gallons per day.

Date Due



